the secreting tissue of the testicle and kidney, and differs from them but in size. The jejunum and ileum, regarded as a continuous tube, constitute a magnificent secreting structure, and its function is probably something more than the supply of the air and mucus generally contained in its canal. It has been suggested, that the blood, the lymph and the fæces owe their existence to the active capillaries of the mesenteric arteries, but some certain proofs are still wanting in confirmation of this opinion.

In the lung-gland, or pneumatiferous organ, the vesicular structure is the secreting element; it secretes carbonic acid: the ramifications of the bronchia ending in the two bronchi represent the excretory duct; the trachea is the receptacle; and the glandular appendage covering the cervix (or cricoid cartilage) and marking its position, passes by the name of the thyroid.

The efferent duct commences at the cricoid and ends at the cartilaginous orifice of the nostrils.

The lacrymiferous organ is formed upon the same plan as the preceding; but in consequence of some peculiarities of development, that, together with the simpler secreting structures, will be reserved for a future opportunity.

November 30, 1853.

At the Anniversary Meeting,

The EARL OF ROSSE, K.P., M.A., President, in the Chair.

Mr. Grove, on the part of the Auditors of the Treasurer's Accounts, announced that the total receipts, during the past year, including a balance of £182 0*s*. 1*d*. carried from the account of the preceding year, amounted to £4791 12*s*. 1*d*.; and that the total expenditure, including an investment of £1367 10*s*. 0*d*. in the Funds, was £3784 14*s*. 6*d*., leaving a balance in the hands of the Treasurer of £1006 17*s*. 7*d*.

The thanks of the Society were voted to the Treasurer and Auditors.

List of Fellows deceased since the last Anniversary.

On the Home List.

The Earl of Brownlow.
Admiral Sir George Cockburn.
Col. Colquhoun.
Bransby Blake Cooper, Esq.
Sir George Gibbes.
Thomas Gordon, Esq.
Robert James Graves, M.D.
Rev. Henry Hasted.
John Hawkins, Esq.
Col. Jackson.
Captain Johnson, R.N.
The Lord Bishop of Lincoln.
Captain Napier, R.N.
Edward William Pendarves, Esq.
Jonathan Pereira, M.D.
The Dean of Peterborough.
Henry Barne Sawbridge, Esq.
George Poulett Scrope, Esq.
Sir William Smith.
John Robert Stewart, Esq.
Lieut. Stratford, R.N.
Hugh Edwin Strickland, Esq.
Rt. Hon. Sir Edward Thornton.
Rev. Charles Turnor.
Frederick Webb, Esq.

On the Foreign List.

François Jean Dominique Arago. | Baron Leopold von Buch.

List of Fellows elected since the last Anniversary.

On the Home List.

James Apjohn, M.D.
John George Appold, Esq.
John Allan Broun, Esq.
Antoine Jean François Claudet, Esq.
Edward J. Cooper, Esq.
E. Frankland, Esq.
John Hall Gladstone, Esq.
The Earl of Granville.
The Earl of Harrowby.
Captain Edward Inglefield, R.N.
Joseph Beete Jukes, Esq.
Robert MacAndrew, Esq.
Charles Manby, Esq.
The Viscount Palmerston.
Joseph Prestwich, Esq.
William John Macquorn Rankine, Esq.
William Wilson Saunders, Esq.
William Spottiswoode, Esq.
Count P. de Strzelecki.

The President then addressed the Society as follows:

Gentlemen,

I am happy that it is in my power again to congratulate you on the progress made in the researches which have been carried on, aided by the Grant the Government have placed at your disposal: after an experience of more than three years we may say with confidence that much has been accomplished. At first there were some misgivings: continental experience was not altogether relied upon. Although it had been very much the practice of foreign governments to take an active part in encouraging the pursuit of science, and with decided success, here the smallest effort in that direction was looked upon by some as an experiment little harmonizing with our institutions, our feelings, perhaps our prejudices, and only to be followed by failure and disappointment. It was feared that because occasionally there had been some difficulty in employing effectively the small fund which had been bequeathed to us, that therefore there would be increased difficulty in employing a larger fund; and this no doubt would have happened if there had been restrictions limiting the application of the larger fund to certain specific objects, or if the field of discovery had been of limited extent: the reverse however was the case. Your Council were not embarrassed by any unwise restrictions, and in science there is room for every one. It is one of the deductions of economic science that labour creates a demand for labour; in fact, that where a community is industrious, and labour accumulates and becomes capital, that there the people will be fully employed: the same is true in the inductive sciences, and it is true universally; there no modifying causes interfere to diminish the force, or limit the application of the great principle, and we see strikingly that as facts accumulate, and facts are the capital of inductive science, fresh employment is everywhere provided for those who are willing to work. Take any one of the inductive

sciences as an example, and we at once see how this is. Take for instance chemistry, compare it as it now is with what it was when Priestley commenced his career. The whole of the science then consisted of an imperfect knowledge of the properties of a few of the metals, of sulphur, phosphorus, and the three alkalies as they were then called. There was a little known also about salts and acids, and the existence of hydrogen and carbonic acid gas had recently been ascertained. In a range so limited there was little room but for one master mind, when Priestley discovered oxygen, and at once an opening was made for researches into the nature of the atmosphere, of water, and of combustion, of the acids and the alkalies, and ample employment was provided for a host of distinguished philosophers for years to come. Other important discoveries were soon made, each becoming as it were a new origin of light, throwing perhaps at first but feeble rays upon the objects around us, but revealing so much of their strange forms as to excite curiosity, and awaken the strongest passion of the human mind,—the desire to discover the truth. Inorganic chemistry was then rapidly becoming a great science, when the foundations of organic chemistry were laid in a succession of brilliant discoveries. That was but a few years ago, but there were many men then ready trained for the work, and the progress was proportionally rapid. To take a few of the discoveries in organic chemistry, and show how each has been the germ of others, as it were the first term of a diverging series, and thus to exhibit the great principle at work that in science labour creates a demand for labour, might perhaps be of some interest, but it would lead me from the object which I have in view, which is simply to point out the grounds upon which I have ever felt a strong conviction, that whatever means were placed at the disposal of the Royal Society, no lasting difficulty could occur in turning them to useful account.

During the last year considerable progress has been made by Mr. Hopkins in the important experiments which he has been carrying on in conjunction with Mr. Fairbairn and Mr. Joule. You no doubt are aware, that, as we descend below the surface of the earth, it has been found that the temperature increases: numerous experiments made in different places with all the necessary precautions to guard against fallacy, seem clearly to have established the fact. The increase is about one degree of Fahrenheit for a depth of from 50 to 60 feet. If therefore the conducting power of the materials of the globe was the same at all depths, we should have a series, which would give us the depth proportional to every required temperature. Reasoning in this way, we conclude that a temperature higher than that of melting iron exists at a depth of thirty miles, and that at double that depth the materials of the surface of the globe, combined as we find them in nature, would enter into fusion. It has therefore been supposed by many that the solid crust beneath our feet is not more than forty or fifty miles thick. It has however been assumed that the increasing pressure at increasing depths does not alter either the conducting power of materials, or the temperature at which they melt. This no doubt is to a certain extent incorrect, and it is highly

probable that the conducting power of the different strata increases considerably with the depth, the materials becoming more compact under augmented pressure. It is not improbable also that pressure may raise the temperature of fluidity. In either case the solid crust of the globe would be thicker than it had been supposed to be on the assumed data. With the view of throwing light upon this question so interesting to all geologists, Mr. Hopkins undertook, with the assistance of Mr. Fairbairn and Mr. Joule, to subject various substances under different temperatures to enormous pressure. Considerable time was required, even with Mr. Fairbairn's unlimited mechanical means, to construct the necessary apparatus; however, recently it has been completed, and in the few substances examined it has been found that the temperature of fusion has increased with the pressure: in the case of wax, by a pressure of 13,000 pounds to the square inch, the fusing-point was raised 30°. Whatever may be the influence of these experiments as affecting the great questions of Terrestrial Physics, we may predict with certainty that data will be obtained most valuable in philosophical research.

Mr. Joule, I find, has been actively engaged, in conjunction with Professor Thomson, in his experiments on the thermal effects of fluids in motion, and has determined with considerable accuracy, operating on a great scale, the depression of temperature when compressed air escapes into the atmosphere through a porous plug. The laws of the phenomena as to the temperature and pressure of the confined gas, will also soon be determined.

Carbonic acid gas has been found to give a depression of four and a half times as great as atmospheric air, while it passes through the porous plug with greater facility than atmospheric air; equal volumes requiring pressures of 1 and 1·05 respectively in order to be transmitted in equal times. Certain heating effects of air rushing through a single orifice have been observed, which will probably lead to a further development of the mechanical theory of the temperature of elastic fluids in rapid motion.

The examination of the sedimentary deposits in the Nile valley, mentioned at the last Anniversary, is still going on. Mr. Horner states, that by the munificent aid of His Highness Abbas Pacha, the Viceroy of Egypt, a series of operations have been carried on at Heliopolis, and at another station thirteen miles above Cairo, which have led to interesting results. A pit has been sunk to the depth of 24 feet below the pedestal of the colossal statue of Ramses the Second, who reigned, according to the chronology of Bunsen, about 1400 years before Christ, and borings have been continued by which cylinders of soil have been extracted at an additional depth of 48 feet. A series of thirty-two pits has been sunk across the valley in a line between the Libyan and Arabian deserts, occupying a line of about five miles, passing through the site of the statue alluded to; and it is proposed to sink a similar line of pits next year about twenty miles lower down the river, passing through the site of the obelisk of Heliopolis. Above sixty persons were employed in the operations at Memphis. The plan, as proposed by Mr. Horner, was, through the

intervention of the Hon. Charles Augustus Murray, Her Majesty's late Consul-General in Egypt, submitted to the Viceroy, and met with the most ready acceptance. He gave directions to his government that every assistance should be afforded for carrying on the proposed researches; he appointed an able engineer officer high in his service, M. Hekekyan Bey, to conduct them, and ordered that the whole expense should be defrayed by his government. Such enlightened liberality on the part of His Highness Abbas Pacha justly entitles him to the gratitude of all cultivators of science.

The other researches alluded to on the last occasion are proceeding satisfactorily, but there is nothing which seems to call for especial notice at present; I will therefore at once proceed to give some account of the steps which have been taken by your Council for the advancement of science in another direction.

In the history of individual sciences we perceive there have been always successive periods of activity and repose. In Astronomy, for many years we have had a period of activity. Physical Astronomy has achieved perhaps its greatest triumph within the last few years in the discovery of Neptune; and the discovery of the numerous Asteroids and Comets is evidence that Practical Astronomy has kept pace with it. Within the same period the nebulous contents of the Southern Hemisphere have for the first time been made known to us; we have now a catalogue of the highest excellence, with an ample guarantee for its accuracy in the zeal, ability, and experience of Sir John Herschel.

That catalogue will be a record for future ages, leading probably to the detection of change in the wonderful objects revealed by the telescope, and so giving a clue to the mysterious laws which rule the remote universe.

The Cape observations were not long before the world when some astronomers expressed a desire that it should not be left to posterity to turn them to account, but that some effort should be made to employ them in the service of the present generation. It was suggested, that with such an admirable working list, much might be effected in a short time. A comparison of the Northern and Southern catalogues had led many to believe that the same instrument had effected more in the Southern than in the Northern Hemisphere. Whether that had been owing to a better atmosphere, or whether the objects themselves were more remarkable, in either case it was reasonable to expect that an instrument of great power would do more in a well-selected situation in the Southern Hemisphere than in these islands; and on that account alone there seemed to be grounds for a well-founded hope that interesting discoveries would be made; but there were other grounds.

In the present state of Nebular Astronomy, the best prospect we have of extending our knowledge, seems to be by carefully sketching and measuring every object sufficiently within reach of our instruments, to make details discernible. It is highly probable that the objects we see are presented to us in every variety of position, that they often differ in form merely because we see them in a different

aspect, and that if all were similarly placed as to the line of sight, a few normal forms would represent the whole. If this is the case, had we a sufficient number of accurate sketches, it is probable that out of the apparent confusion we should succeed in extracting the normal forms. It is also probable that in the nebular systems motion exists. If we see a system with a distinct spiral arrangement, all analogy leads us to conclude that there has been motion, and that if there has been motion that it still continues. The apparent motion is probably very slow, owing to the immense distance of the nebulæ; still there are double stars known to be physically double from their motions, which are probably as distant as some of the nebulæ. In certain nebulæ stars are so peculiarly situated that we can scarcely doubt their connection with the nebular system in which we see them, and some of these stars are as bright as some of the stars known to be physically double; as bright even as some of the stars which the latest Pulkowa observations have shown to have sensible parallax, and whose distance therefore is approximately known. We have therefore some vague idea, resting on probable evidence, even of the distance of the nearest nebulæ. It seems therefore not unreasonable to expect that measurements perseveringly carried on will detect motion, and that a fulcrum will thus be obtained, by which the powers of analysis may be brought to bear upon the laws which govern these mysterious systems.

In the northern catalogue of Nebulæ, and the same observation no doubt applies to the southern also, there are vast numbers much too faint to be sketched, or measured, with any prospect of advantage; the most powerful instruments we possess, showing in them nothing of an organized structure, but merely a confused mass of nebulosity of varying brightness. The number of nebulæ in the northern hemisphere, in which details are well brought out, is not very large, and even in these, a great proportion of the measurements are necessarily rough, and wanting in that precision by which the motion of certain double stars was so soon detected. It is evident therefore that to obtain a true knowledge of the forms of the nebular systems, our sketches must be as numerous as possible; and to obtain evidence of motion with rough measures, our measures should be very numerous also; but the northern hemisphere presents but a very limited list of suitable objects, therefore it is desirable to take in the southern hemisphere also.

I have thus, I believe, in part at least, explained the views of those who felt anxious that the southern hemisphere should be examined with a telescope of great power: the first attempt to give practical effect to their wishes was at the meeting of the British Association held at Birmingham in 1849.

The President of the Association was on that occasion directed to apply to Government to send a telescope of great power, in charge of an experienced observer, to the southern hemisphere. That application was unsuccessful; the Government, while they acknowledged the importance of the proposed object, declined to proceed, from an apprehension of difficulties, through which they did not then see

their way clearly. At a subsequent meeting of the British Association, the matter was again discussed, and a Committee was appointed, to take such measures as they considered best calculated to effect the object. The Committee, in the first instance, laid the whole matter before your Council, and the Council, approving of the suggestion, appointed a Committee to consider the subject in detail.

It was necessary before the Government could be applied to with a reasonable prospect of success, that a specific plan should be in readiness, complete in all its details: the size of the instrument, its optical principle, its mounting, and its site.

With the view of obtaining the best information, the Committee consulted several eminent men, conversant with the management of large instruments. The first question proposed was, whether the instrument should be a refractor or reflector, and it was decided in favour of the reflector—there was in fact no choice. In the present state of knowledge, there was no probability that a good refractor could be constructed of sufficient power. As to size, the Committee were disposed to recommend a telescope of 4 feet aperture, and 35 feet focal length, to be mounted equatorially; not that an instrument of that size was the best, a much larger no doubt would have been better, but it would have been obviously unwise to have recommended a plan involving a very large expenditure. The Committee proceeded one step further, they pointed out a mechanical engineer of character and experience in the construction of optical instruments, who was willing to undertake to make the instrument for a specific sum, and having proceeded thus far, they laid the whole matter before Government, with whom it at present rests.

Another application is also before the Government of a very different character, but with the same great object, the advancement of human knowledge: it is to provide a building for the reception of the Scientific Societies of the metropolis. That application did not proceed from your Council, but from a large number of individuals, many of them Fellows of this Society, the remainder distinguished members of the other Scientific bodies of the metropolis. The application was made in the shape of a Memorial to Government, the signatures amounting to about 200. There had been no effort, I believe, on the part of those who brought the subject forward to procure a large number of signatures, or in any way to obtain a direct representation of the Scientific bodies: the Memorial was a preliminary step, and in that stage nothing more was required, than to show that it was supported by a large number of persons of that class, from which science, if called upon, would have selected her representatives. The Memorial was presented by a deputation, and care was taken to explain to Government, that it did not emanate officially from this Society or from any other.

A detailed explanation was also entered into, showing in what way the cultivation of science would be promoted, by providing suitable accommodation for the scientific societies. Carleton ride was suggested as a convenient situation, and other sites were named in the same neighbourhood.

Reference was made to the suggested site at Kensington, and it was explained that it would be inconvenient to a large proportion of the working men of the Societies, many of them engaged in business, and whose time was most valuable, that they would be unable to attend regularly, and that the usefulness of the Societies would be thereby greatly impaired. It was also intimated that the purchase of a large tract of land at Kensington did not materially affect the question; as a small space would be sufficient for all the Societies, and therefore that a free grant at Kensington could be but little object. Should the Government accede to the Memorial, I presume that then the Societies will be regularly consulted. The site will then be pointed out, the plan of the building laid before you, and you will form your own opinion; you will decide whether to remain as you are, or to accept the enlarged accommodation, which the far-sighted liberality of the nation will have provided for you.

The interests of science appear to me to be deeply involved in the question of providing a suitable building for the Scientific Societies. It is a practical question, and we must look at it in all its bearings, as men of the world. Had there been no Societies, science would not therefore have stood still; but its progress would have been much slower. The desire of discovering the truth, which is so strongly implanted in every educated mind, would have been to some a sufficient motive for exertion; but the aid and inspiriting influence of association would have been wanting, and many active members of our scientific bodies would probably never have taken up science as a pursuit at all. The love of ease, the fascinations of society, the little prospect of advancing their material interests, through the path of scientific discovery, would have been to them a sufficient excuse for indolence. This point was very well put at the last Anniversary, by one of the distinguished men to whom you awarded a medal; he said, had he been like Robinson Crusoe on a desert island; the desire of discovering the truth would have been an inducement to work, but to obtain the good opinion of his fellow-men, associated together, was with him a very strong additional inducement. If a man, naturally gifted, and well-educated, attends scientific meetings, he will feel himself constrained to work, and therefore it is so important for the advancement of knowledge, that able men should be induced to join and attend the different societies; but nothing I think would have greater attractions than a building in a convenient central situation, where the business of science would be transacted, where there would be access to the best libraries, and where that kind of society most valued by scientific men would always be within reach.

Where the question is, shall a great country like England provide a suitable place of meeting for its scientific bodies, I should hope there are not many who would be disposed to count the cost, I scarcely think the question, *cui bono*, could be asked; should any one however ask it, I should answer, the object is to promote the increase of human knowledge, to extend the domain of reason; and "it is the understanding that sets man above the rest of sensible beings, and gives him all the advantage and dominion which he has over them." To take lower

ground, science is a part of England's greatness: without science England would be nothing, and in the race with the world, if she is forsaken by science, she will fall far behind. The exact sciences are the foundation of navigation; they are the foundation of engineering; and many of our manufactures are based on principles, which have been evolved in the researches of a refined chemistry. Besides, have we not sometimes been at fault where science was not ready to guide us? We have heard of failures in ship-building: some ships sail slowly, and are therefore of little use; others roll, and strain, and are also condemned; where we have succeeded best we have taken our models from abroad, where high science has long been urged, to lend its aid in naval construction: where such men as the two Bernouillis, Euler, Chapman and others, have been induced to examine and discuss the questions of most interest to the practical builder. In civil engineering too, our most eminent men, I am sure, would not hesitate to acknowledge their obligations to our neighbours. We have long been almost unrivalled in the applications of steam; and yet, who is there who has not sought for the theory of the locomotive in the essay of De Pampour, or the principles of steam in general in the researches of Regnault?

In military engineering too, as well as in naval architecture, has not science been sometimes on the side of our adversaries? and have we not in consequence suffered severely? But let me not be mistaken. I do not contend that science can in a moment increase our success in the arts, upon which the greatness of this country depends. If we were to say to the mathematician, give us the best lines for a ship suited to a given purpose, however profound his mathematical knowledge might be, he would fail; practice must be combined, but in due subordination with theory. It is where in a nation science is cultivated profoundly by a large class of persons, and circumstances exist tending to direct it to practice, that some men will always be found, gifted with the faculty of applying it in whatever way the interests of the country may require.

Popular science, however, will not do: it has its uses, subordinate as they are; it must be science of a high order; science as taught at our universities: there a power is created capable of effecting great objects, but in too many cases it is not applied at all, and it soon passes away without useful result. Were it possible to enlist that gigantic power into the service of the country by making our scientific Associations more inviting, by placing science in this metropolis in a position more attractive, a result would be obtained which the merest utilitarian would consider of immense value.

I deeply regret that the last accounts have brought no intelligence of Sir J. Franklin's expedition, and that science has sustained a heavy loss in the death of a distinguished French officer; the latest sacrifice to the perils of Arctic discovery.

Many now present were acquainted with Lieut. Bellot, and I am sure they will bear me out in this, that there was a singleness of purpose, and a propriety of feeling in everything he said and did, in perfect keeping with the tenor of his previous life; and though

he was here so short a time, he was regarded as a friend by all who knew him.

You have heard no doubt with sincere pride, that British valour, and British perseverance, have at length solved the problem of the north-west passage. A question of great geographical interest has thus been settled, and an important fact has been added to the data of terrestrial physics. In all future inquiries relative to the oceanic currents, the tides, the variations of temperature, the winds, and meteorological phenomena generally, it will no longer be a doubtful assumption, that the sea flows freely around the northern coast of America.

It now only remains for me to state, and I have the greatest pleasure in doing so, that your Society is prosperous. The publication of your Transactions proceeds regularly, and they continue to be, as they have been for two centuries, the records of every important addition to British science. There is no indication of a diminished anxiety to share in your labours, the candidates for admission are numerous, and your Council have had no difficulty, though acting under a heavy responsibility, in pointing out to you the required number of persons in every way worthy of the Fellowship.

So far the present system of election appears to me to have worked extremely well. The Fellowship is sought for as a high honour, and here, as at the Universities, the claims of the respective candidates are tested by responsible persons.

In this, the Royal Society differs from every other Society; and I think upon the preservation of that distinction, the welfare, the position, perhaps the existence of our Society depends. For 150 years the Royal Society stood alone; unaided it bore the whole labour of wielding the power of Association, in the cause of progressing science. Recently other Societies were formed to meet more fully the wants of individual sciences; not as rivals to the Royal Society, (in all of them our Fellows have held very prominent places) but as the most friendly allies; not dependent on the Royal Society, but fully admitting its pre-eminence.

These Societies have rendered important services; much has been effected through their means which otherwise would not have been attempted. Science has been carried out by them in the utmost detail. Besides, it is a law of human nature, that we usually form a high estimate of the importance of the pursuit we are engaged in; and in a Society limited to one science, that feeling will necessarily predominate, and will act as a stimulus to exertion. Under its influence, labour will be cheerfully borne, from which under other circumstances we should recoil with disgust. That feeling, however, would proceed too far were there not here a power to restrain it: you hold that power: you exercise a presiding influence over all the Societies. The leading members of the scientific bodies have their places here, and science is fully represented.

You look at science as a whole, and you weigh the value of every new discovery as adding to the mass of human knowledge. The honour of contributing to your Transactions is eagerly sought for,

the medals you award are in high estimation, and science is stimulated to its grandest efforts, because you are viewed by all as just and able judges. To hold securely that proud position, learning must be your distinguishing attribute; in the altered state of things it is learning which fits you for your new duties, and so long as the Fellowship is regarded as the reward of services in the cause of science of no common order, or of proved scientific eminence at the universities, so long, I think, we may predict with confidence that the Royal Society will flourish.

COLONEL SABINE,

I am happy to have the honour of handing to you the Copley Medal in charge for Professor Dove.

Three important branches of Terrestrial Physics have recently been greatly advanced, and by similar means; the adequate discussion of accumulated results of observation—I allude to the tides, terrestrial magnetism, and the distribution of heat over the surface of the globe. Our knowledge of the tides was limited, and fragmentary, till it became extended and systematized by the researches of Dr. Whewell, and notwithstanding the numerous detached observations which had long been made on the effects of terrestrial magnetism, we were still ignorant of much of the real laws of the phenomena, till under the leading influence of Gauss, not only individuals, but Governments were induced to unite in measures for obtaining the accurate and systematic observations, which in the hands of Colonel Sabine are leading to such determinate and interesting results. The labours of Dr. Whewell and Colonel Sabine have received their well-merited acknowledgements in the Medals which have been respectively awarded to them; and this year the Copley Medal has been awarded to Professor Dove for his laborious and valuable researches on the *distribution of heat over the surface of the globe*. The results obtained in all these cases constitute unquestionably great steps in the progress of science; and though labours such as these may not necessarily demand that acute discrimination and inventive faculty required for the discovery of truths before unthought-of, they do require what is scarcely less valuable, those enlarged and comprehensive views by which we are enabled to recognize real order in the midst of apparent confusion, and deduce from the most complex and intricate phenomena, the simple laws to which they may be referable. The work which Professor Dove has recently completed comprises the results obtained by him during many years, by the careful and elaborate discussion of an immense number of recorded observations of the temperature at numerous stations, and in almost every accessible region of the globe. The details of these discussions have been published by him at different times, principally in the Transactions of the Berlin Academy. In this recent work a large map exhibits the isothermal lines for January and July, the months of extreme winter and summer temperatures; while twelve small maps engraved on two sheets exhibit the isothermals for each successive month, and enable us to trace at

once their changing positions with the changing seasons. Twelve other small maps of subnormal lines show, in like manner, for each month, the difference between the actual mean temperature for that month, and the *normal* temperature (that due to the latitude) at all places situated along each abnormal line. These, with other subsidiary maps, present to us at once, and with the greatest perspicuity, the principal results of these laborious investigations.

These maps are accompanied by a considerable quantity of letter-press, containing not only descriptive details, but also a very able discussion of some of the principal results obtained, and of the general conclusions deducible from them; more especially as regards the causes of the abnormal temperatures which characterise the northern hemisphere. The influence of oceanic currents, on the temperature of the regions in which they prevail, was very inadequately appreciated before the publication of these researches. Of these currents, the most important, and infinitely the most interesting to ourselves, is that so well known as the Gulf-stream. Its immense influence in moderating the winter cold along the shores of western Europe is shown by the singularly abnormal position of the winter isothermals in that region; and not only is this fact of great interest in itself, and of first-rate importance in meteorology, but it has also enabled the geologist to form a far more accurate estimate than otherwise it would have been possible to have done, of the probable climatal influences of particular configurations of land and sea, and thus to overcome, not by arbitrary hypothesis, but by logical deduction, some of the greatest apparent anomalies in speculative geology. The former existence of glaciers in our own islands need no longer be regarded as a mystery, for it is now demonstrable that they would be the highly probable, if not the absolutely necessary consequences of any configuration of land and sea which should divert the Gulf-stream from its present course; and the geologist has no difficulty in conceiving such a configuration, not merely as a possible, but as one which probably did exist during the glacial period. I mention this as an instance of the diffusive influence of a great step in one science, on the progress of other sciences more or less directly associated with it. A further and very important conclusion has been deduced by Professor Dove from the monthly isothermals, I mean the fact that the mean temperature of the surface of the globe, as a whole, is higher when the sun is in the northern, than in the southern signs. The explanation is, that the northern hemisphere has more land than sea at the surface, and the southern much more sea than land, and that from the different action of the sun's rays on the solid and fluid surfaces, it follows that the hot summer of the northern hemisphere added to the mild winter of the southern, gives a mean of general temperature several degrees of Fahrenheit higher than the cool summer of the southern, together with the cold winter of the northern hemisphere.

It will, I doubt not, be generally felt by all who are acquainted with these researches, that Professor Dove has well merited the honour which the Council has conferred upon him in this award of the Copley Medal.

Mr. Darwin,

I have much pleasure in announcing that a Royal Medal has been awarded to you.

Adopting the views of Sir Charles Lyell, who has sought to explain natural phenomena by an appeal to the evidence afforded by still active causes, you have observed with great care, and no one has been more judicious, or more successful, in collecting facts. The frequent references made to your labours by writers on general geology, are evidence of the estimation in which they are held. Your work on Coral Reefs is a fine specimen of an able argument on facts. In that work you have brought together all the information collected by others, as well as by yourself, and you have explained the facts observed relating to the distribution of coral reefs, the conditions favourable to their increase, the rate of their growth, and the depth at which they are found; and thus laying a sound foundation to reason upon, you have shown that, with few exceptions, the old theory, that these reefs have been formed on the edges of submarine craters, and generally that the rocky or other basis on which the corals have grown had been *elevated, is incorrect*; and, on the contrary, that the true theory is, that the surface has been gradually brought down to the proper level, a depth for the growth of corals, by gradual subsidence. No one probably can read your book without assenting to the general truth of your reasoning; and as it places the fact of *subsidence* beyond doubt, a fact more difficult to prove than elevation, and exhibits it on a scale of magnitude and generalization quite commensurate with that of elevation, I think it must be accepted as one of the most important contributions to modern geology.

In your Monograph on the Pedunculated Cirripeds, you have treated generally of the structure, economy, and zoological relations of these animals, and given a systematic arrangement and description of the different species. In the accomplishment of your task, you have not only made use of previously existing materials with sound and enlightened criticism, but, by the discovery of new facts and the promulgation of original views, contributed most materially to advance the department of knowledge to which your researches more immediately belong, and rendered valuable service to physiological science in general.

In the course of your inquiries you have confirmed and widely extended the observations of your predecessors respecting the larval condition of the Cirripeds, and have shown that all the perfect Lepads and Balanids pass through successive stages of metamorphosis. You have also added largely to our knowledge of the anatomy of the larva, and brought to light the curious fact, that in one of its stages its mouth is altogether rudimentary, and perfectly closed up by the external covering, so that the creature in this stage is in fact a "locomotive pupa," incapable of feeding. You have further observed that the prehensile antennæ with which the larva fixes itself in its final change, invariably remain permanent in the adult animal

at the attached end of its peduncle, and in many cases afford important characters for zoological discrimination.

The knowledge thus gained from the study of development is most sagaciously and happily applied by you to explain the homological relations between the Cirripeds and Crustaceans; and in this way you have conclusively shown that the peduncle of the mature Lepad corresponds with the three anterior segments of the Crustacean. Again, by your discovery of *Proteolepas*, a new parasitic Cirriped of low organization, you have been able successfully to compare the remaining segments of the body in the two classes; for whilst the chain of evidence is in some measure broken by the absence of two segments near the middle of the series in Cirripeds generally, the missing links are supplied by the newly-discovered animal referred to.

The existence of an eye with a pair of ophthalmic ganglia in adult Lepads, as had been previously shown in Balanids,—the presence too of organs seemingly intended for hearing and smelling—the chemical nature of the tegumentary coverings—the cement-gland and ducts, yielding a plastic material for attaching the peduncle and for other special purposes in particular instances, and the singular organic connexion between that gland and the ovaries, are all most interesting discoveries in comparative anatomy, first made known in your work.

Some very singular facts respecting the reproductive function in the Lepadidæ have been brought to light through your researches. You observed that the ova, on leaving the ovary, are gathered in a layer underneath the internal lining of the sac or mantle, from whence they are freed and extruded by the process of moulting, and then form the ovigerous lamellæ already known. Again, you have clearly established, that, contrary to the hitherto received opinion, there are species of Lepadidæ consisting of individuals of distinct sexes, the male being parasitic on the female; and in certain other species you have discovered a condition hitherto unknown in the animal kingdom, namely, bisexual individuals impregnated by parasites simply of the male sex, which you name "complemental males,"—a fact unquestionably of first-rate interest in relation to the physiology of the reproductive function in general.

Besides these more important observations, there are many more of lesser mark to be met with in the descriptions of particular species,—descriptions, it may be observed, which are founded on a careful examination, not only of the external characters, but of the internal structure of the animals in question, in specimens obtained from every available source, both at home and abroad; and the zoological distinctions are rendered more precise and intelligible than heretofore, by the introduction of a consistent and philosophical nomenclature.

The President then called upon Mr. Christie to read the following obituary notices of some of the deceased Members.

Jonathan Pereira, M.D., was born on the 22nd of May, 1804, in the parish of Shoreditch, London. At ten years of age he was placed in a Classical Academy in Queen Street, Finsbury, where he remained about four years, and distinguished himself as one of the most promising pupils in the school.

Dr. Pereira's education was now directed to the pursuit of surgery, but his appointment to the office of Resident Medical Officer of the General Dispensary in Aldersgate Street in 1823, led to his devoting himself more especially to the practice of medicine.

In 1826 he succeeded Dr. Clutterbuck as lecturer on Chemistry at the Aldersgate Street Dispensary, His first lecture was devoted to an account of the rise and progress of Chemistry from the earliest date to which the history of the science could be traced, and comprised a notice of the latest discoveries. The theatre was crowded to excess, and the lecture created no little sensation from the profusion of illustrations, the amount of information, and the style of his delivery. Among other illustrations he exhibited bromine, which had recently been discovered by Balard, of Montpellier.

His cultivation of chemistry at that time in connexion with medicine, naturally directed his attention to the subject of the substances used as medicinal agents, and in 1824 we find him publishing a translation of the 'London Pharmacopœia.' This was followed by 'A Manual for the Use of Students,' 'A general Table of Atomic Numbers, with an Introduction to the Atomic Theory,' and other works for the use of those who were pursuing their medical studies with a view to passing the usual examinations. He afterwards published numerous papers on the adulteration and properties of drugs; and thus prepared himself for his great work—that on which his reputation as a physician and man of science will principally rest,—his 'Elements of Materia Medica.' The outlines of this work first appeared as a course of lectures in the London Medical Gazette. This work contained by far the most complete and accurate account of substances used in medicine that had ever been published. Not only were sources of medicine and their commercial history fully treated therein, but the author entered with great caution and skill into inquiries connected with the action of remedies: and thus his book became at once a standard of reference for all who were engaged in the business of selling drugs and chemicals, or in the duty of prescribing them as medicines. The first volume and a part of the second of a third edition of this work had been published at the time of the author's decease. In 1843, Dr. Pereira published a treatise on diet; which at the time of its appearance was one of the most philosophical works that had yet been produced on the subject of the food of man, and 'Lectures on Polarized Light,' the best familiar exposition of that abstruse subject in our language. He also contributed numerous articles to societies, journals, reviews, etc.

His death has left a great void in English Pharmaceutics, as no one in England had a greater amount of knowledge on that subject. As a lecturer, he secured the attention of his class by an earnestness of purpose, aptness of experimental illustration, and the practical bearing of his remarks.

Early in the year 1832 he resigned his office at the General Dispensary, and on this occasion a silver salver was presented to him by the Governors of that Institution, as a memento of their regard and esteem. In the following September he married, and established himself in general practice in Aldersgate Street.

In the winter of 1832 he became Professor of Materia Medica in the New Medical School in Aldersgate Street; and at the same period succeeded Dr. Gordon as Lecturer on Chemistry at the London Hospital.

His connexion with the London Hospital procured him the opportunity of being appointed Physician to that extensive institution. In 1841 he procured the licence to practise in London from the College of Physicians. He was elected a Fellow of that body in 1845. On the establishment of the London University, he was appointed Examiner in Materia Medica and Pharmacy,—a position which he held till his death. He took great interest in the establishment of the Pharmaceutical Society, and delivered lectures on Materia Medica in connexion with that body.

Dr. Pereira was the distinguished and highest representative of that science which involves the history, properties, and uses of drugs, better known on the Continent than in England by its name of Pharmacology. At the recent meeting of the Association for the Advancement of Science at Wiesbaden, there was a Pharmacological Section specially devoted to the subject, attended by upwards of two hundred members. 'The Elements of Materia Medica and Therapeutics,' to which Dr. Pereira gave the best years of his life, is considered to be one of the most elaborate and thoroughly worked-out productions of modern science. Compared with similar pharmaceutical works of France and Germany, it is remarkable for its diversity of character, excelling greatly in the amount of commercial and other practical information, in the preciseness and value of its notes, and in the scrupulous exactness with which its statements are authenticated by references to their original source. Where obscurity attached to any statement, the author was careful to express it with a mark of doubt. As a painstaking and conscientious writer Dr. Pereira was unsurpassed, and his work contains nothing that may not be thoroughly relied on for its accuracy. He also added largely to the botany of pharmacy.

Dr. Pereira had the happiness of enjoying during his life large honours, and there is little doubt, had he been spared, he would have reaped the more substantial rewards of a lucrative practice.

He was elected a Fellow of the Royal Society in 1838, and was chosen on the Council in 1842–44. He was also a Fellow of the Linnean and other Scientific Societies, and was in constant communication with the learned of all countries.

His death, which took place on the 20th of January last, was the result of an accident. Being engaged at the College of Surgeons on some scientific business, he fell down a flight of steps, which led to the rupture of an artery, and terminated his life at the early age of forty-nine, not however without leaving behind a name which will occupy a prominent place in the history of the science of the nineteenth century.

Hugh Edwin Strickland, Esq., was descended from an ancient Baronet family in Yorkshire, one of whose ancestors was Lord Strickland in the Protectorate of Cromwell. From early life Mr. Strickland was a zealous student of Natural History, and in consequence of his proficiency in all its branches, but particularly in Ornithology and Geology, was appointed to succeed Dr. Buckland as Reader in Geology at the University of Oxford, and was subsequently elected President of the Ashmolean Museum. Besides frequent and valuable zoological, botanical, and geological contributions to periodical publications, Mr. Strickland obtained great celebrity by the publication of an elaborate volume on the Extinct Dodo, which he wrote in conjunction with Dr. Melville. Mr. Strickland was elected a Fellow of the Royal Society in 1852.

His death was most melancholy. He left Hull, where he had been attending the Meeting of the British Association in September last, to visit an interesting geological locality, on the line of railway between Retford and Gainsborough. Here, while engaged in taking a sketch, and imprudently standing on the railway, he was run down by an express train, and in an instant was a mangled corpse.

François Arago was born on February 26th, 1786, at Estagal near Perpignan, in the department of the Oriental Pyrenees. His father had only a moderate patrimony, and was Treasurer of the Mint at Perpignan. Being intended for the legal profession, or some public office, the early education he received was entirely literary, but having a predilection to become an officer in the Artillery, he entered himself at the Polytechnic School at Paris, and with but little aid from masters, instructed himself from the works of Euler, Lagrange, and Laplace, instead of resorting to the manuals where science is retailed at second-hand. In 1803, when he was eighteen years of age, he was received by the younger Monge at Toulouse, and a year afterwards, on account of the superiority of his scientific attainments to the rest of his companions, he was recommended by the elder Monge to the Observatory at Paris. This occasioned a change in his original destination, and opened for him a career far more useful to science and mankind. Whilst in the capacity of observer at this national establishment, he occupied himself with researches of the greatest value to astronomy and physics.

The death of the astronomer Mechain had interrupted the measurement of the meridian of France, undertaken to determine the figure of the earth, and to establish, on a scientific basis, the unit of the decimal system of measures adopted by the National Convention.

For this object, Delambre and Mechain had already measured the part of the meridian between Dunkirk and Barcelona. To continue this operation to the Balearic islands, Messrs. Biot and Arago set out for Spain in the year 1806, and were joined by the Spanish commissioners, Chaix and Rodriguez. In April, 1807, M. Biot returned to Paris to announce the results which had already been obtained, and Arago was left with M. Rodriguez to perform all the operations necessary to unite, geodesically, the islands of Majorca, Ivica, and Formentera; he thus measured, by means of a single triangle, a meridional arc of a degree and a half. At this time, rumours of the approaching war between France and Spain caused the Majorcans to regard with suspicion the nocturnal signals made on the heights of Galatzo, which they imagined were intended to direct the march of the French troops; Arago was thereupon taken up as a spy, and imprisoned, on the 2nd of June, 1808, in the citadel of Belver, from whence he contrived to escape with his instruments, and embarked on the 28th of July for Algiers.

The French consul procured him a passage, on the 13th of the same month, for Marseilles; but on entering the bay of Lyons, when in sight of the coast of Provence, the ship he was on board was captured by a Spanish privateer, and carried to Rosas on the 16th of August. After residing for some time in a windmill, and passing himself off as a travelling pedler, he was imprisoned, with the companions of his voyage, on the 25th of September, in the fort of the Trinity, and on the 17th of October was thrown into the hulks of Palamos, where he underwent great hardships, and was often left for two days together without food. It happened that the Algerine vessel in which Arago was captured, contained two lions sent as a present by the Dey to the Emperor Napoleon; one of these animals had died in consequence of neglect or ill-treatment on the part of the Spaniards, and the Dey threatened reprisals on the Spanish government unless satisfaction was given, and the vessel immediately restored. On the 28th of November, 1808, Arago reimbarked for Marseilles, but in consequence of the incompetence of the pilot, after being driven about the Mediterranean for several days, was landed at Bougie, from whence he proceeded on foot, disguised as an Arab, to Algiers. He arrived at this city on the 26th of December, but a revolution had taken place immediately before; the former Dey had just been beheaded, and disputes having arisen between the French and Algerine governments, the new Dey refused Arago permission to depart, and, had it not been for the protection of the Danish consul, the future academician would have been sent as a slave to the galleys. Fortunately, another revolution broke out; the new Dey was hung, and Arago was enabled to leave Algiers on the 21st of June, 1809; but his misfortunes had not yet entirely ceased, for when he was in sight of Marseilles, the vessel in which he had embarked was pursued by an English frigate, from which however it escaped, and Arago was safely landed, after his three years of adventure, with all his instruments, at Marseilles on the 2nd of July.

On the 17th of September, 1809, Arago was nominated to succeed Lalande as member of the Academy of Sciences by forty-seven out of fifty votes. He was then only twenty-three years of age.

A short time after Arago's admission into the Institute, he was appointed professor at the Polytechnic School, where, on account of the variety and extent of his knowledge, he was able to give successively five courses on different subjects. He was also chosen Examiner of the Engineer and Artillery officers leaving the School of Application at Metz. In 1812 the Bureau of Longitudes appointed Arago to give a course of lectures on astronomy at the Observatory, and this course was continued until 1845; a more eloquent expounder of the truths of science was never heard within these or any other walls, and crowded audiences from every class of society followed, with profit and pleasure, the facile expositor of subjects so difficult. It was justly said by the present ruler of France, when in his captivity at Ham, that Arago "possessed, in a high degree, those two faculties so difficult to meet in the same man; that of being the grand priest of science, and of being able to initiate the vulgar into its mysteries."

In 1821, Arago was engaged in making geodesical observations on the coasts of France and England, and in 1822 he was nominated member of the Bureau of Longitudes. The notices, which from 1824 to the present time, Arago furnished to the Annuaire of the Bureau of Longitudes, for the instruction of the unlearned public on various important points of science, are perfect models of what such writings should be. In the words of M. Combes, President of the Academy, "They will always be reperused with the same pleasure by men of science and by the ordinary reader; in them we find an admirable clearness, with an erudition as correct as it is extensive, and joined thereto, the most rigorous accuracy in the statement of the phenomena, and the consequences which result from them."

On the 7th of June, 1830, Arago obtained the honour which he valued the highest, being elected to succeed Fourier as Perpetual Secretary of the Academy of Sciences. He received on this occasion thirty-nine out of forty-four votes.

After the revolution of 1830 broke out, Arago entered into political life; he was elected deputy for his native department, and became a member of the Municipal Council of Paris. In both these capacities he had many opportunities of rendering service to science and advancing public improvements.

The revolution of 1848 evolved another change in the fortunes of Arago; he became one of the members of the Provisional Government, and was nominated Minister both of the Marine and of War. On his retirement from these onerous offices, for his services in which he never made the slightest demand upon the national treasury, disheartened with the state of public affairs, he entirely relinquished politics, and devoted himself with renewed ardour to his duties as Secretary of the Academy; he commenced putting in order and perfecting his numerous unpublished researches, and continued to do so until increasing infirmities prevented him. In May 1852

he was called upon, with all other public functionaries, to take the oath of allegiance to Louis Napoleon, as President of the Republic; this his antecedents and his convictions would not allow him to do, and he resolved, rather than put this constraint on his conscience, to abandon the establishment with which his name had been so gloriously identified. Happily, he was spared this wrong; the Prince President authorized his Minister to inform him, that he made "a special exception in favour of a philosopher whose labours had rendered France illustrious, and whose existence the Government would be loath to sadden." Arago did not long survive this event; a complication of disorders was carrying him to the grave; he returned, after a painful journey to his native place, seriously indisposed, and died at the Observatory, on the 2nd of October in the present year. His funeral took place on the 5th, at the cemetery of Père la Chaise; a brigade of infantry marched with the procession, and the Emperor was represented at the ceremony by Marshal Vaillant, Grand Marshal of the palace. Though it rained incessantly, above 3000 persons attended the funeral cortège.

Arago was but once married, and had the misfortune to lose his wife, a lady of great accomplishments, in 1829. He has left two sons: Emanuel, a member of the Parisian bar, and formerly representative with his father for the Oriental Pyrenees; and Alfred, a painter of distinguished reputation.

It now remains to give a short retrospect of the most prominent original investigations in physical science made by this indefatigable philosopher during the intervals of a busy and sometimes agitated life.

The important discoveries of Malus relating to polarized light attracted the attention of Arago strongly to this new and fertile field of physical research, and on the 11th of August, 1811, he read to the Academy a memoir abounding with new and beautiful facts, each forming a starting-point for subsequent investigations which have extended in no mean degree our knowledge of the laws of light. In this valuable communication, M. Arago examined, for the first time, the changes in the properties of polarized rays when they pass through plates of mica, sulphate of lime, and other crystals; he showed that they acquire the property of being divided by a bi-refringent prism into two complementary coloured pencils; and he examined the changes of colour and intensity dependent on the thickness of the plate, its inclination to the ray, its rotation in its own plane, and the rotation of the analysing prism; he also ascertained that when the emergent light was reflected from a glass plate at the polarizing angle, only a single-coloured image appeared, which changed to the complementary colour when the mirror was turned round 90°, the angles of incidence and reflexion remaining constant. He also discovered the different remarkable modifications which a polarized ray undergoes when transmitted through a thick plate of rock crystal cut perpendicular to its axis, viz. that it is analysed by a bi-refringent prism into two complementary rays which remain the same, however the plate is turned in its own plane, and pass through all changes of colour in successive order, when the analysing

prism is turned round; phænomena very different from those of the crystalline plates he at first examined. These experiments, followed by the more extensive researches of Biot, Fresnel, Brewster, and many more recent investigators, have created a beautiful and important branch of physical optics, designated that of chromatic polarization. In this memoir it was also first announced, that while the light from a clouded sky undergoes no modification, that reflected from the atmosphere when the sky is unclouded is polarized, the intensity of the polarization varying with the hour of the day, and the position of the point with respect to the sun.

In 1816 Arago published a fact which has been generally received as an *experimentum crucis* between the two rival theories of light, that of emission and that of undulations. Dr. Young had shown that two rays of light, emanating from the same source, act conjointly when they pass over equal paths, or paths differing by an even number of times a certain very small quantity, and that they destroy each other when this difference is an uneven number of times the same quantity; whence it follows that the interference of two rays under the stated circumstances produces a series of fringes alternately dark and bright. Dr. Young further ascertained that the interposition of an opaque screen in the path of one of the rays completely prevents the formation of the fringes. Arago ascertained that if one of the rays be made to pass through a thin transparent film, such as glass, the fringes are displaced towards the side to which it is applied, the magnitude of the displacement depending on the thickness of the film. This proves that the transmitted ray has been retarded in its passage, a result conformable with the theory of undulations, but in direct opposition to that of emission. Arago subsequently showed how this principle might be employed to measure the minutest differences in the refractive densities of bodies, to resolve various delicate questions in physics, and in the construction of new meteorological instruments.

In 1819 Arago and Fresnel published their joint experiments on the action which rays of polarized light exert on each other. By a variety of ingenious methods, they proved that rays polarized in the same plane mutually interfere with each other, producing fringes as in the case of ordinary light; while rays polarized in planes at right angles manifest no appreciable action on each other. They also showed that two rays primitively polarized at right angles to each other and afterwards brought to similar planes of polarization, produce fringes only when they have proceeded from a pencil originally polarized in the same plane. These new properties enabled Fresnel to give a *complete* explanation of the production of colours in crystalline plates, which Dr. Young had *before* referred to the interference of the transmitted rays, though he was unable to explain in what circumstances the interference took place, or why we see no colours unless *polarized* light be transmitted through the crystalline plates.

Hitherto Arago's original researches had been confined to subjects connected with Astronomy and Physical Optics, but the great discovery of Œrsted gave his inventive ingenuity another direction.

On the 4th September, 1820, he gave an account to the Academy of the recent investigations of the Danish philosopher, and was in consequence charged to repeat them before that body. In preparing these experiments he ascertained some hitherto unobserved phenomena. M. Œrsted had discovered the action which the voltaic current exerts on a steel needle *previously magnetized*; M. Arago found that the same current developes the magnetic power in bars of iron or steel, which are at first deprived of this property, and that the magnetism thus communicated to soft iron is temporary, ceasing with the removal of the current, while that imparted to steel is permanent. He also found, adopting a suggestion of Ampère's, that steel needles were more strongly magnetized by placing them within a helix forming part of the circuit. These discoveries subsequently led, in the hands of others, to the invention of the electro-magnet and its valuable applications; also to a ready means of making permanent magnets of great power.

On the 22nd of November, 1824, Arago communicated to the Academy the results of a series of experiments, showing the influence which metals, not magnetic, and other substances exert on the magnetic needle; this effect being to diminish rapidly the amplitude of the oscillations without sensibly changing their duration: and on the following 7th of March he announced a still more remarkable discovery, the reverse, as it were, of the preceding. Since a needle in motion is stopped by a plate at rest, M. Arago thought that a needle at rest ought to be carried along by a plate in motion; and he accordingly found that on rotating a copper plate, for instance, beneath a magnetic needle, the needle was moved out of the magnetic meridian and stopped in a position more distant from it in proportion as the rotation of the plate was more rapid; and if this motion were sufficiently quick, the needle rotated itself continuously round the thread from which it was suspended. He added some further facts relating to this subject on July 23rd, 1826. These beautiful experiments proved the important fact, that bodies, which in a state of rest exert no action on a magnet, become capable, when they are in motion, of acting upon it as if they are magnetic. Mechanical motion was thus, for the first time, shown to play an important part in the manifestations of electric phenomena. No satisfactory explanation was, however, given of these experiments until Faraday, in 1832, referred them to the more general laws of electro-magnetic induction which he had then discovered.

In 1839, Arago laid before the Academy a proposed system of experiments by means of which the theory of emission and that of undulations might be submitted to decisive proofs. The object of this communication was to show that the method invented and employed by Mr. Wheatstone to measure the velocity of electricity in metallic conductors, was equally applicable to measure the comparative velocities of light in air and in a liquid. By following the indications of this memoir and employing Mr. Wheatstone's revolving mirror, aided by many original and ingenious arrangements of his own, M. Foucault has recently completely succeeded in realizing these anticipations of Arago.

A passing allusion is all that can be made to other important in-

vestigations of this active-minded philosopher. We owe to him the discovery of a neutral point in the polarization of the atmosphere; the determination, by simultaneous hourly observations with M. Kupffer of Kasan, of the synchronous perturbations of the magnetic needle at places very distant from each other; a series of delicate experiments in photometry, and various experimental verifications of Fresnel's theory; a new method of measuring the diameters of the planets; and many valuable astronomical and meteorological observations.

In the autumn of 1834 Arago visited this country. His principal object was to make himself acquainted with the methods of observation employed at the Royal Observatory at Greenwich, then under the direction of Mr. Pond. He also attended the meeting of the British Association which was that year held at Edinburgh; on this occasion he received a diploma of the freedom of the city, and was nominated an honorary member of the Association. He made several interesting communications to the Physical Section; and the Committee having requested him to state his views as to any points on which it appeared to him it might be useful for the British Association to co-operate with the Institute of France, he noticed in particular "the great advantage which might be expected to accrue to magnetical science from the establishment of observatories furnished with adequate instruments, and under the superintendence of a competent observer, throughout the extensive possessions of the British empire, and dwelt on the necessity of arranging magnetical observations upon a uniform and well-approved plan."

The ensuing year the Committee of the British Association acted on this suggestion, by resolving that an application should be made to the Government to carry it into effect. In 1836, the Royal Society, on whose attention the subject was strongly urged by Baron von Humboldt, added its weight to the recommendation, and the joint endeavours of these two bodies resulted in the establishment by Her Majesty's Government and the East India Company, of numerous magnetic observatories in widely separated parts of the British dominions, co-operating with others instituted in various parts of Europe and the United States of America. It is to be regretted, that, notwithstanding M. Arago's strong interest in this great scientific combination, no corresponding observations were made in Paris; Algiers having been the only station established at his suggestion in the French Empire.

M. Arago was elected a foreign member of the Royal Society in 1818, and on two subsequent occasions the Council of that body marked their sense of his high scientific merits by adjudging to him in 1825 the Copley Medal, "for his discovery of the magnetic properties of bodies not containing iron," and again in 1850, the Rumford Medal, "for his experimental investigations on polarized light."

The late Rev. Charles Turnor, M.A., F.R.S., and F.R.A.S., was an ardent benefactor to Science. He was born in Lincolnshire on the 10th of August, 1768; and after receiving the first rudiments of education at Grantham, graduated in Trinity College, Cambridge. On the 15th of May, 1802, he was instituted to the vicarage of

Wendover, at the foot of the range of the Chiltern Hills, in Buckinghamshire; the duties of which he faithfully exercised for many years. In 1818 he was collated to the prebendal stall of Sutton-in-the-Marsh, in the cathedral church of Lincoln, by Bishop Pretyman Tomline, on the death of the Rev. Dr. Charles Burney; and in 1825, obtained a dispensation to hold the vicarage of Milton Ernest, in the county of Bedford. He resigned this vicarage, and all other preferments, excepting his prebend, in 1837. Beloved and respected by all who had the pleasure of his acquaintance, he passed a long life in active utility, and died on the 12th of January, 1853.

Mr. Turnor was descended from an ancient family of Stoke Rochford, and Penton House in the county of Lincoln. Among his ancestors were Sir Edmund Turnor, Paymaster to the Forces in the reign of Charles I., who was taken prisoner at the battle of Worcester in 1651; and his brother Christopher Turnor, one of the Barons of Exchequer in 1660. The property of Sir Isaac Newton, being only three miles from Stoke Rochford, was purchased by the family about four years after Newton's death, and its integrity remains much the same as in Sir Isaac's time. This circumstance led Mr. Charles Turnor during a series of years to collect medals, papers, portraits, and all he could find connected with the illustrious philosopher, regardless of trouble or expense; and in 1847 he erected an obelisk, 64 feet high, in the park of Stoke Rochford, with an appropriate inscription written by himself.

The interest which Mr. Turnor felt in the progress of science, is amply evinced by his valuable and useful donations to various institutions, and the liberal sums he bequeathed them. Besides being a real patron of the sterner branches of knowledge, he was an excellent artist, and a critical judge of all objects of taste.

There remains but to add, that Mr. Turnor bequeathed the above-mentioned interesting memorials of Newton to the Royal Society, on the understanding that the collection, which he did not live to finish, should be completed.

On the motion of the Rev. Baden Powell, seconded by Dr. Roget, the best thanks of the Society were given to the President for his excellent Address, and his Lordship was requested to permit the same to be printed.

The Statutes relating to the election of Officers and Council having been read, and the Rev. John Barlow, and Captain Younghusband having, with the consent of the Society, been nominated Scrutators, the votes of the Fellows present were collected.

The following Nobleman and Gentlemen were reported duly elected Officers and Council for the ensuing year:—

President—The Earl of Rosse, K.P., M.A.

Treasurer—Colonel Edward Sabine, R.A.

Secretaries— { Samuel Hunter Christie, Esq., M.A.
William Sharpey, M.D.

Foreign Secretary—Rear-Admiral W. H. Smyth.

Other Members of the Council.—Thomas Bell, Esq.; Rev. James Booth, LL.D; Warren De la Rue, Esq.; Captain Robert Fitzroy, R.N.; Thomas Graham, Esq., M.A.; William Robert Grove, Esq., M.A.; Joseph Dalton Hooker, M.D.; Thomas Henry Huxley, Esq.; Henry Bence Jones, M.D.; George Newport, Esq.; John Phillips, Esq.; Sir Frederick Pollock, M.A.; Rev. Baden Powell, M.A.; George Gabriel Stokes, Esq.; William Tite, Esq.; Charles Wheatstone, Esq.

***Statement of the Receipts and Payments of the Royal Society between Dec.* 1, 1852, *and Nov.* 30, 1853.**

RECEIPTS.

				£	*s.*	*d.*
Balance in the hands of the Treasurer at the last Audit ..				182	0	1
Weekly Contributions, at one shilling				39	0	0
Quarterly Contributions at £4				1080	0	0
17 Admission Fees				170	0	0
6 Compositions for Annual Payments at £60				360	0	0
3 Compositions for Annual Payments at £40				120	0	0
One year's rent of estate at Mablethorpe: due at Michaelmas 1852	116	16	0			
One year's Income Tax	3	8	0			
				113	8	0
One year's rent of estate at Acton: due at Michaelmas 1852	52	9	2			
One year's Income Tax	1	9	9			
				50	19	5
One year's Fee farm rent of lands in Sussex: due at Michaelmas 1853				19	4	0
One year's rent from Royal College of Physicians				3	0	0
Dividends on Stock:—						
One year's dividend on £14,000 Reduced 3 per cent. Annuities	420	0	0			
Less Income Tax	12	5	0			
				407	15	0
One year's dividend on £7705 9*s.* 10*d.* 3 per cent. Consols	231	7	3			
Less Income Tax	6	18	11			
				224	8	4
Half a year's dividend on £1359 18*s.* 6*d.* ..	20	7	6			
Less Income Tax	0	11	4			
				19	16	2
One year's dividend on £3452 1*s.* 1*d.* 3 per cent. Consols, produce of sale of premises in Coleman Street......................	103	11	2			
Less Income Tax	3	0	4			
				100	10	10
Carried forward..........				2890	1	10

	£	s.	d.	£	s.	d.
Brought forward..........				2890	1	10
Donation Fund.						
One year's dividend on £5331 10*s.* 8*d.* Consols	159	18	6			
Less Income Tax	4	13	0			
				155	5	6
Rumford Fund.						
One year's dividend on £2430 12*s.* 5*d.* Consols	72	17	9			
Less Income Tax	2	1	9			
				70	16	0
Fairchild Fund.						
One year's dividend on £100 New South Sea Annuities				3	0	0
Bakerian Lecture and Copley Medal Fund.						
One year's dividend on £366 16*s.* 1*d.* New South Sea Annuities	10	18	0			
Less Income Tax	0	6	2			
				10	11	10
Wintringham Fund.						
One year's dividend on £1200 Consols	36	0	0			
Less Income Tax	1	1	0			
				34	19	0
Miscellaneous Receipts:—						
Sale of Philosophical Transactions, Abstracts of Papers, and Catalogues of the Royal Society's Library				291	7	11
Sale of Three Acres Two Roods and One Perch of Acton Estate to Railway Company				1067	10	0
Bequest from the Rev. C. Turnor to complete Newton Memorial				250	0	0
Balance from Balloon Committee due to Donation Fund				18	0	0
Total Receipts......				£4791	12	1

PAYMENTS.

	£	s.	d.	£	s.	d.
Fairchild Lecture.—The Rev. J. J. Ellis, for delivering the Fairchild Lecture for 1853				3	0	0
Bakerian Lecture.—Colonel Sabine, for delivering the Bakerian Lecture for 1853				4	0	0
Salaries:—						
S. H. Christie, Esq., one year, as Secretary..	105	0	0			
Thomas Bell, Esq., one year, as Secretary ..	105	0	0			
Ditto for Index to Phil. Trans.	5	5	0			
Admiral Smyth, one year, as Foreign Secretary	20	0	0			
Charles R. Weld, Esq., one year, as Assistant-Secretary	300	0	0			
Mr. White, one year, as Clerk	100	0	0			
Porter	40	0	0			
				675	5	0
Carried forward..........				682	5	0

				£	s.	d.
Brought forward				682	5	0
Purchase of £1359 18*s*. 6*d*. 3 per cent. Consols				1367	10	0
Fire Insurance, on the Society's Property				45	1	6
Gratuity to Bank Clerks				1	1	0
Bills:—						
Taylor:						
Printing the Phil. Trans., 1852, part 2	208	9	9			
Ditto, 1853, part 1	79	17	6			
Ditto, 1853, part 2	53	10	0			
Ditto, Proceedings, Nos. 90—97; Circulars, Lists of Fellows, Ballot-lists, Statement of Payments, Minutes of Council; Government Grant Committee, Notices, &c. &c.	144	19	9			
				486	17	0
Basire:						
Engraving and Printing Plates in Transactions, 1852, part 2	121	17	6			
Ditto, 1853, parts 1, 2 and 3	208	10	6			
Aldous:						
For Engraving	6	6	0			
				336	14	0
Gyde:						
For Wood Engraving				10	10	0
Bowles and Gardiner:						
Paper for the Phil. Trans., 1852, part 2, and 1853, parts 1 and 2				202	0	0
Gyde:						
Boarding and Sewing 800 Parts of Phil. Trans., 1852, part 2	22	18	0			
Ditto, 1853, part 1	11	6	2			
Ditto, part 2	9	14	2			
Ditto, Copies for Authors	15	19	7			
				59	17	11
Tuckett:						
Bookbinding	49	17	3			
Hyde:						
For Stationery	10	9	0			
Saunderson:						
For Shipping Expenses	9	16	6			
Brecknell and Turner:						
Candles, and Lamp Oil	42	1	6			
Carried forward				3191	16	5

				£	s.	d.
Brought forward..........				3191	16	5
Meredith:						
Mats, Brushes, Fire-wood, &c.	7	7	3			
Cubitt:						
For repairs and relaying Carpets, &c.......	25	19	5			
Shoolbred and Co.:						
For Furniture........................	9	16	6			
Laing:						
For Painting	19	19	3			
Charlton:						
For Cases and Shelves	3	19	6			
Humphries:						
For Livery	5	10	0			
Tea, Waiters, &c. at Ordinary Meetings	32	15	4			
Powers, Cleaning Rooms and Books	10	16	0			
				228	7	6
Books purchased:						
Dulau and Co.: for Books	29	0	0			
Taylor: for ditto	22	2	3			
Gould: for ditto	15	15	0			
Williams and Norgate: for ditto	7	10	0			
Quaritch: for ditto	37	14	0			
Bumstead: for ditto..................	16	13	0			
Second-hand, ditto	44	12	0			
				173	6	3
Taxes:						
Land and Assessed Taxes	16	5	10			
Income Tax	4	19	2			
				21	5	0
Illuminating Sheets, for Newton Memorial				26	12	0
Wintringham Fund:						
Governors of Foundling Hospital				34	19	0
Petty Charges:						
Postage and Carriage..................	38	10	3			
Expenses on Foreign Packets, &c.........	3	1	3			
Stamps	0	12	6			
Charwoman's Wages..................	26	0	0			
Extra Cleaning	6	0	0			
Miscellaneous expenses	34	4	4			
				108	8	4
Balance in the hands of the Treasurer				1006	17	7
Total....				£4791	12	1

EDWARD SABINE, *Treasurer.*

November 30*th*, 1853.

Estates and Property of the Royal Society.

Estate at Mablethorpe, Lincolnshire (55 A. 2 R. 2 P.), £116 16*s*.
Estate at Acton, Middlesex (29 A. 0 R. 1 P.)
Fee farm rent in Sussex, £19 4*s*. per annum.
One-fifth of the clear rent of an estate at Lambeth Hill, from the College of Physicians, £3 per annum.
£14,000 Reduced 3 per cent. Annuities.
£21,478 12*s*. 6*d*. Consolidated Bank Annuities.
£466 16*s*. 1*d*. New South Sea Annuities.

The Receipts during the past year, exclusive of the Balance of the last year and the Receipts from the Donation, Rumford, Fairchild, Wintringham, Bakerian and Copley Fund, Turnor Bequest, and sale of portion of Acton Estate, were £2999 9*s*. 8*d*.

The Expenditure during the same period, exclusive of £1067 10*s*. 0*d*. invested in the Funds, arising from the sale of land, and £300 received for compositions in 1852, and of sums paid on account of Trust Funds, was £2355 13*s*. 6*d*.

Excess of Income over Expenditure including Compositions £643 16*s*. 2*d*.

The augmentations to the Library included in the Expenditure of the present year, exclusive of binding, amount to £173 6*s*. 3*d*.

Cost of printing the Transactions, 1852, Part II. and 1853, Parts I. and II. £950 19*s*. 2*d*.
Balance in hand belonging to the Wintringham Fund, £34 19*s*. 0*d*.

The following table shows the progress and present state of the Society with respect to the number of Fellows:—

	Patron and Honorary.	Foreign.	Having compounded.	Paying £2 12*s*. Annually.	Paying £4 Annually.	Total.
December 1, 1852..	11	49	420	15	272	767
Since elected......	......	......	+8	......	+11	+19
Since compounded	......	......	+2	......	−2	
Defaulters	......	......	......	......		
Withdrawn	......	......	......	......		
Since deceased	......	−2	−16	−1	−8	−27
November 30, 1853	11	47	414	14	273	759

Receipts by Annual Contributions.

1830	£363	4	0
1831	286	0	0
1832	255	6	0
1833	283	7	6
1834	318	18	6
1835	346	12	6
1836	495	0	0
1837	531	0	0
1838	599	4	0
1839	666	16	0
1840	767	4	0
1841	815	12	0
1842	910	8	0
1843	933	16	0
1844	1025	16	0
1845	1010	0	0
1846	1074	0	0
1847	1116	8	0
1848	1122	16	0
1849	1130	16	0
1850	1146	4	0
1851	1117	12	0
1852	1135	0	0
1853	1119	0	0